N° 18,444 A.D. 1905

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COMPLETE SPECIFICATION.

Improvements in or relating to Centrifugal Liquid Separators

I, JOHAN PETTER JOHANSSON, of Enkoping, Sweden, Managing Director of Enkopings Mekaniska Verkstads Aktiebolag, Enkoping, Sweden, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to improvements in centrifugal liquid separators of that class which comprise thin plates, which, arranged in a circle about the central inlet tube of the drum, extend, in a direction deviating from the radius of the drum, from the said tube to the wall of the drum, bearing against the said wall in a position parallel or slightly inclined to the axis of the drum.

Generally, the said plates are curved in such a manner as to deviate from the radius of the drum more and more toward their outer edge, but they may be broken or even straight having an oblique position with relation to the radius. In order to keep the plates assembled so that they keep together when inserted into or taken out of the drum, they are generally connected at their inner or outer edges in such a manner, that they can swing, and bear freely against each other when rotated with the drum. In order that the plates may not be pressed close together by the centrifugal force they are provided with distance pieces, soldered to them, or with projections or the like for keeping them at suitable distances from each other. The said strips or projections on the plates must be rather numerous or the plates will be bent between the strips or projections and become warped.

This invention relates to an arrangement of the plates differing from those stated above which renders the said distance pieces or projections superfluous, the spaces between the plates being thus open and free entirely along their whole surface. Owing to this fact the plates may be fixed to each other at their inner edges as the open spaces are so accessible that the cleaning operation can be effected without the plates being further separated. By this arrangement the liner, as a whole, becomes a single firm body which can easily be put into and taken out of the drum, and also can be more easily handled than liners composed of a plurality of small pieces.

The said object is attained by the liner, that is the whole set of plates, being made conical or convex at its top as well as at its bottom with the axis of the cone coinciding with the axis of the drum and by the drum being correspondingly shaped inside at the top and at the bottom, so that the liner is positively supported along its conical or convex surface by the drum.

As the said surfaces of the liner are the same as the top and bottom edges respectively of the plates, each plate has in this manner a positive support against the drum at the top edge as well as at the bottom edge along its whole length between the inner edge and the outer edge. Owing to this fact it is held in a reliable manner in its position and prevented from bending during the rotation.

[*Price 8d.*]

For additional security the plates are given a special curved shape, so that for the greater part of their length, their edges fall more or less in a line circumferential to the central axis of the drum, thereby preventing the plates from sliding outward along the surfaces of the cones. At the same time the space, that is the distance between the plates will become great near the centre of the liner and small at the circumference of same which is a great advantage since the milk-layers then are thin where the centrifugal force is greatest and the slow-running cream has to overcome less resistance or get better room near the centre, between the plates. If desired the said bearing surfaces may be provided with notches with which the plates engage.

Figure 1 in the accompanying drawings is a side view of the liner:

Figure 2 is a vertical section of the drum and the liner mounted in the same:

Figure 3 is a horizontal section of the said parts:

Figure 4 is a side view of a single plate, and

Figure 5 is a top view of the same:

Figure 6 shows a cap which is placed over the liner under the upper lid or cover:

Figure 7 shows a modified form of the top and bottom ends of the liner:

Figure 8 shows a modification in vertical section, consisting in the bearing surfaces for the liner being provided with notches with which the plate-edges engage:

Figure 9 is a side view, and

Figure 10 a top view of a further modification.

1 1 designate the plates of the liner. The said plates, which are rather stiff, are arranged in a circle about a common central axis at equal distances from and fixed to each other at their inner ends so that together they form a firm body of the form shown in Figures 1 and 2. The inner ends of the plates are bent in an angle and with the flanges 2 thus formed rivetted to a tube 3. The said tube, however, may be dispensed with and the plates connected directly by the said flanges 2 overlapping each other and being rivetted to each other thus forming a tube also. In both cases the tube may be solid or perforated. The outer ends of the plates are bent outward in order to bear firmly against the wall of the drum. When the liner is taken out, the spaces between the plates are fully open or free axially throughout the liner and also outward at the circumference of the liner, so that a doubled piece of cloth or the like can easily be introduced with the fold into one space after the other when the plates are to be cleaned. Owing to their stiffness the plates will maintain the distances shown in Figure 3. The liner is conical both at the top and bottom, the said form being attained through each plate being made wider axially at the inner edge than at the outer edge in such a manner that the width is increased by the same or substantially the same amount upward as downward. The chamber of the drum 4 has a similar form at the top and at the bottom, as shown in Figure 1, the bottom wall (either wholly or partially) having the same conicity as the bottom end of the liner, and the skimming disc or inner cap 6 (either wholly or partially) having the same conicity as the top end of the liner. Over the said cap, between the same and the upper end wall 7 of the drum a space 8 is provided, as usual, in which the necessary supports 9 for the cap 6 are mounted. The said supports consist of projections on the upper side of the cap, some of which take the form of a short pin or the like, while some of them comprise a flange extending from the neck 10 of the cap to the outer edge of the same. These flange like supports act as wings, which prevent the blue milk from stopping in the rotation in the space 8 between the cover 7 and the cap 6, and also act as guiding surfaces towards the centre for the same. As the liner, the central tube 3 of which is adapted to be slipped on the inlet tube 11 of the drum, is inserted in the drum and the nut 12, which serves to press both the drum

parts 4 and 5 toward each other, is tightened, the liner will be firmly jammed between the bottom 5 and the cover 6 7. In this manner each plate will firmly bear against the said conical parts 5 and 6 with their bottom and top edges respectively and is thereby firmly supported at the bottom end as well as at the top end. Owing to this fact each plate is prevented from bending or changing position during the rotation, though no special distance pieces are mounted between the plates. The new milk led into the tube 11 passes outward from the tube into the liner through the holes 13 at the bottom. To ensure the entrance of the milk into the spaces between the plate a hollow ring 14 open at its inner side is loosely mounted on the tube 11, said ring being provided with a hole 15 for each space, or a larger number of holes may be provided. As the plates extend very near to the ring, the plates being for that purpose provided with a notch for the ring at their inner bottom corner, the milk will pass from the ring directly into the spaces and, consequently, is accurately distributed to all the spaces. The blue milk passes through the space 8 and leaves the drum through the exit opening 16. The level of the blue milk and consequently the level of the cream in the more central spaces may be controlled by means of the screw 17 screwed into the neck of the drum from the outside of same and extending into a channel 18, provided in the inner side of a ring 19, mounted in the said neck and preventing the blue milk from passing upward except through the channel 18, the depth of which can be regulated by the screw. The cream passes upward through the cap neck 10 and outward through the exit opening 20. The liner may bear directly against the conical cover 7 and the blue milk and the cream leave the liner through pipes for which there are provided apertures in the upper end of the liner, unless the tubes are mounted in grooves provided in the cover itself. The aim of supporting the plates outward against the drum at their top and bottom ends is gained also by giving the ends of the liner a spherical shape or such a shape, as shown in Figure 7, so that its outlines form wave-lines or step-like lines. The main point is that the plates are supported outward at their top as well as their bottom ends and not only at their top ends or only at their bottom ends as the plates then would instantly become warped by the action due to centrifugal force. A further modification may consist in the inner side of the drum being provided at the top and the bottom with notches or grooves for the plates, said grooves having longitudinally the same form as the plates and being so formed in cross-section that the plate, the edge of which engages the notch, is firmly supported outward. This arrangement is shown in Figure 8, in which 21, 21 are the grooves. In this case the end of the liner may be in a flat plane or even in a plane inclined inward, either conical or of any other form, the conical form shown in Figure 8 is however most practical.

The form of the plates shown in Figure 3 is characterised by the fact that the plates extend from their inner edges apart from the flanges 2, for a considerable part of their length transversely, in a radial or substantially radial direction, in order that the spaces between the plates may be as wide as possible near the centre of the liner. The plates are then sharply bent into the desired oblique position to the radius of the drum and continue in that direction outward to the circumference of the liner. Owing to this arrangement the plates will have a considerable length transversely and are, near the circumference, at a very short distance from each other, so that the milk-layers are very thin where the centrifugal force acts with the greatest power, the greatest effect being thus gained. The cream will, however, easily find its way toward the centre and its passage is facilitated by rotating the drum and the liner in the direction in which the plates are bent, that is, in the direction indicated by the arrow in Figure 3, so that also the inertia of the cream mass will cause the cream to pass more quickly in the spaces.

When the detachable liner is to be cleaned it is threaded on a long pin or

the like and is moved backward and forward in the cleaning liquid. Owing to the fact that the spaces are fully open or free and abruptly cut off at their inner ends, that is, do not converge into acute angles or have any other narrow shape, the liner will be very easy to clean. Consequently the form of the plates is of great importance for the cleaning of the liner. Regarding the conical form of the liner at the top and the bottom and of the support for the same at the top and the bottom of the drum it is, evidently, also suitable in the case of the well known plates movably hinged or connected to each other at a common centre or in the case of one or more projections being provided between the plates, at or near their centre, and adapted to serve as a support between the same, or in the case of the plates being bent in an uneven line or in a series of flat surfaces. At their outer edges the plates may bear directly against the wall of the drum or against rings threaded on the liner or the like.

The providing of supports between the plates, mentioned above, may, possibly, be taken into consideration when the liner has a considerable width. Thus, for instance small pins 22 may be mounted between the outer ends of the plates, as shown in Figures 9 and 10, so that the plates are fixed to each other or bear firmly against each other by the pin fixed to the one plate bearing against the next plate, provided with a groove, if necessary. One or more pins are used according to the height of the liner.

Having now particularly described and ascertained the nature of my said invention, and in what manner the same is to be performed, I declare that what I claim is:—

1. In liners for centrifugal liquid separators of that class comprising bent or irregular plates arranged in an annular series about the axis of the drum parallel or substantially parallel to the said axis but inclined to the radii of the drum, the combination with a liner having both at the top and bottom a conical step-like or convex form concentric with the axis of the drum, of a containing drum having both its top and bottom correspondingly shaped (wholly or partially) for the purpose of supporting each plate both at its top and bottom ends and thus preventing warping during the rotation, substantially as described.

2. A liner for centrifugal liquid separators of the kind described, characterised by the plates being firmly connected at their inner edges and free, open spaces being provided between the plates, substantially as described.

3. Liners for centrifugal liquid separators of the kind described characterised by the spaces between adjacent plates being wide near the centre but narrow near the circumference owing to the plates extending radially or substantially radially near the centre and then being bent so that they extend circumferentially or approximately so substantially as described.

4. A form of liner for centrifugal liquid separators of the kind described characterised by the fact that the plates are rivetted to or in any other suitable manner fixed to a tube (perforated if necessary), and situated at a comparatively great distance from each other about the said tube, so that there are large spaces between the plates extending completely to the tube, or that the plates, bent to form an angle at their inner edges, are connected directly, so as to form together a tube (perforated if desired) substantially as described.

5. A modified form of centrifugal liquid separator of the kind described characterised by the top and bottom bearing surfaces for the plates having a series of grooves or notches engaged by the ends of the plates and corresponding in form to that of the plates which are supported outward by the grooves, the said bearing surfaces being conical, convex, plane or of any other suitable form dependent of the form of the liner end which may be conical, convex, plane, or, if necessary slightly inclined inward, substantially as described.

6. The complete centrifugal liquid separator substantially as described or illustrated in Figures 1, 2, 3, 4, 5, and 6 or in Figure 8 of the accompanying drawings.

Dated this 12th day of September 1905.

BOULT, WADE & KILBURN,
London Agents.

Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1906.

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JOHANSSON'S COMPLETE SPECIFICATION.

14 SHEETS.
SHEET 1

Fig. 1.

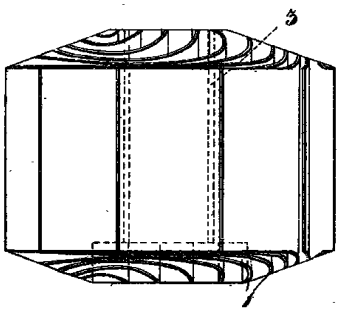
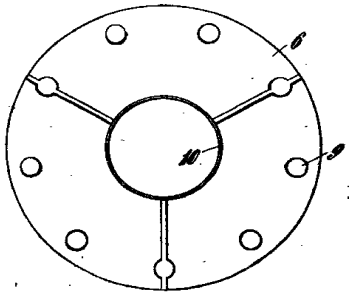


Fig. 6.



SHEET 2

Fig. 2.

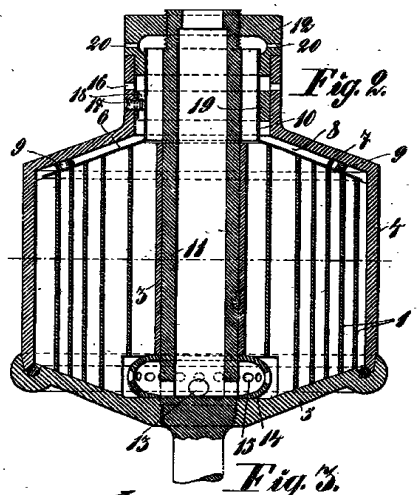


Fig. 3.

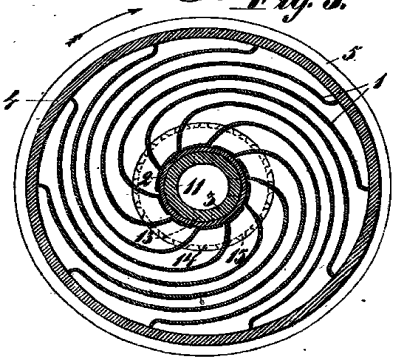


Fig. 1.

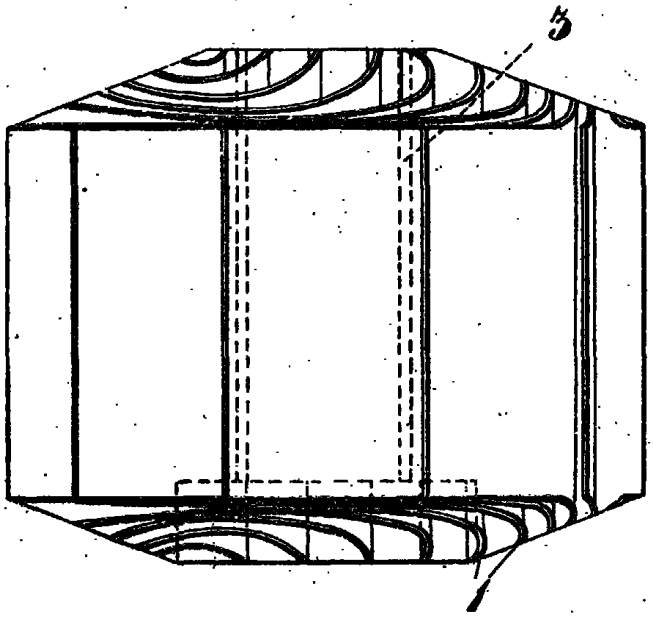
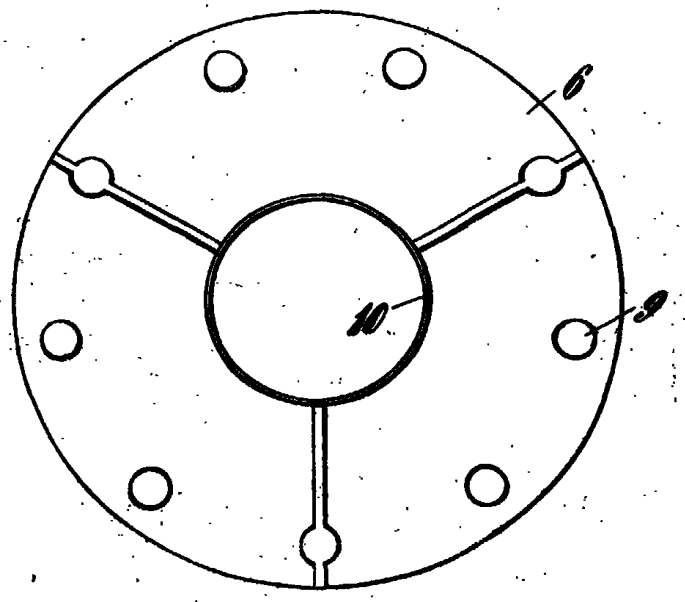


Fig. 6.



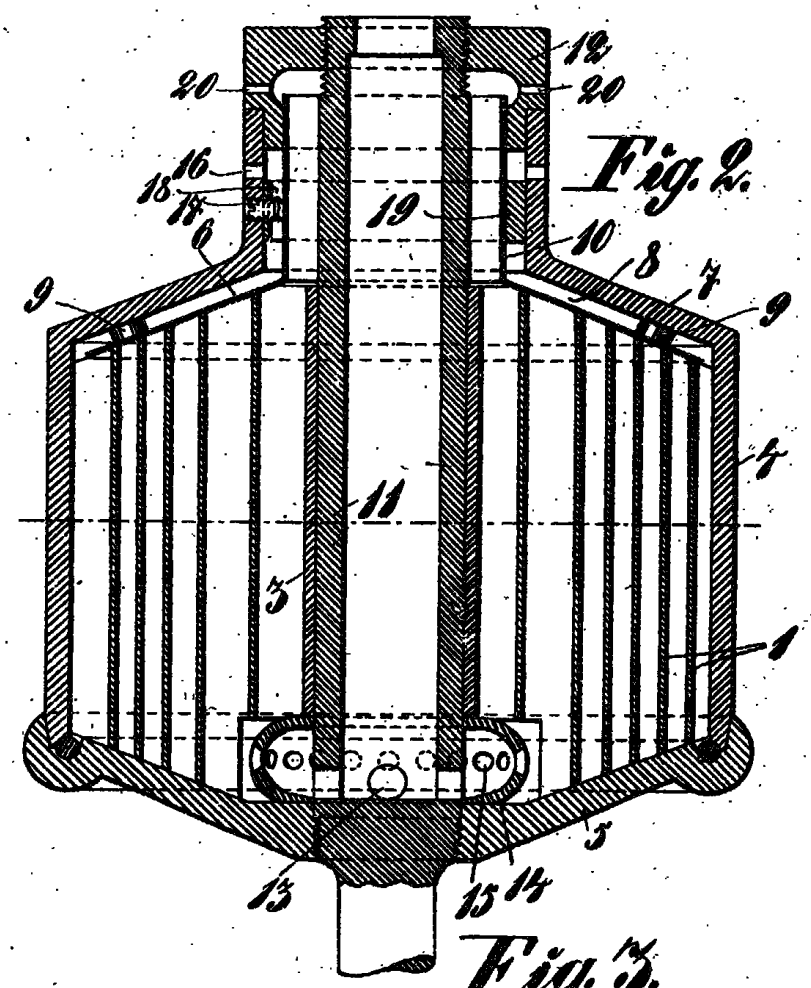


Fig. 2.

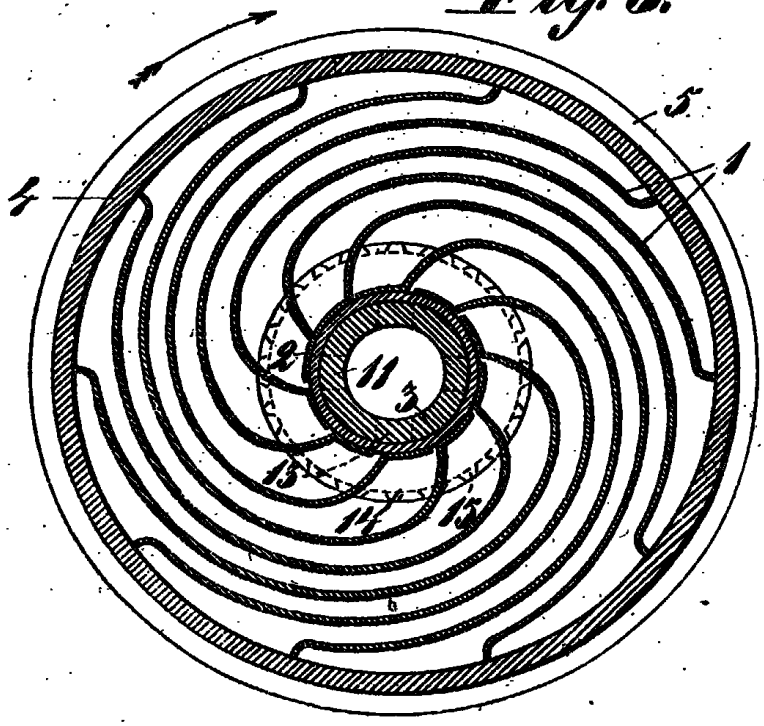


Fig. 3.

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JOHANSSON'S Complete Specification.

Fig. 7.

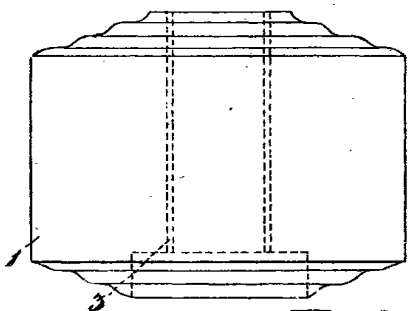


Fig. 4.

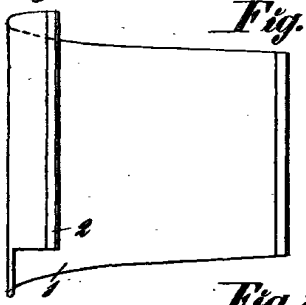


Fig. 5.

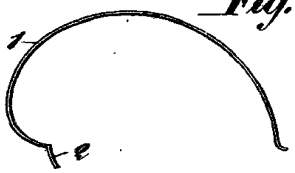


Fig. 8.

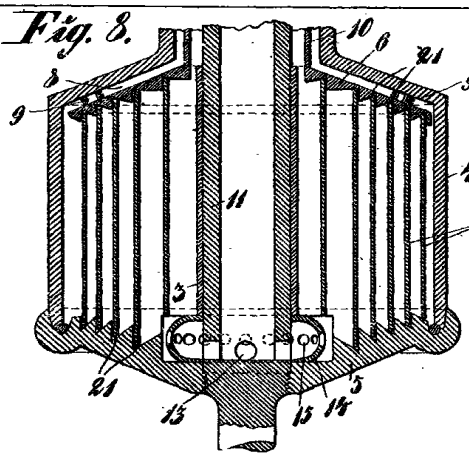


Fig. 9.

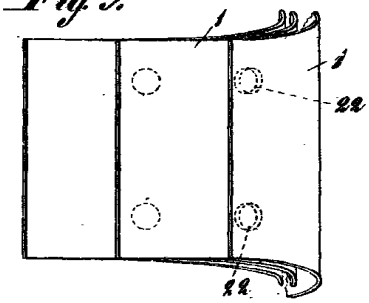
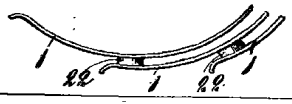


Fig. 10.



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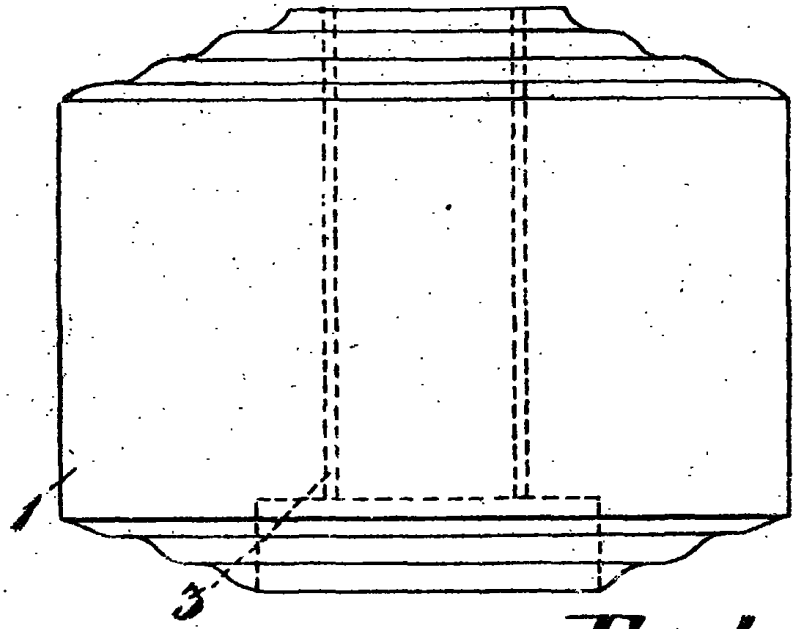
[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 3.



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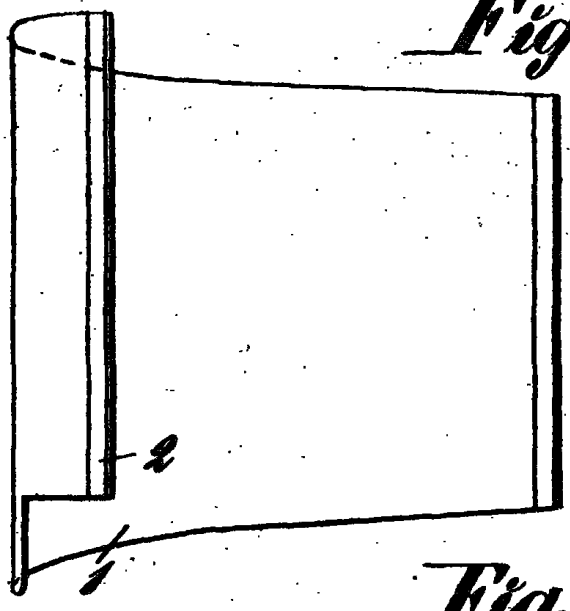


Fig. 5.

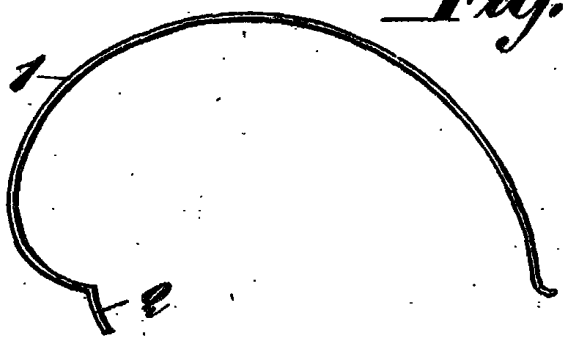


Fig. 8.

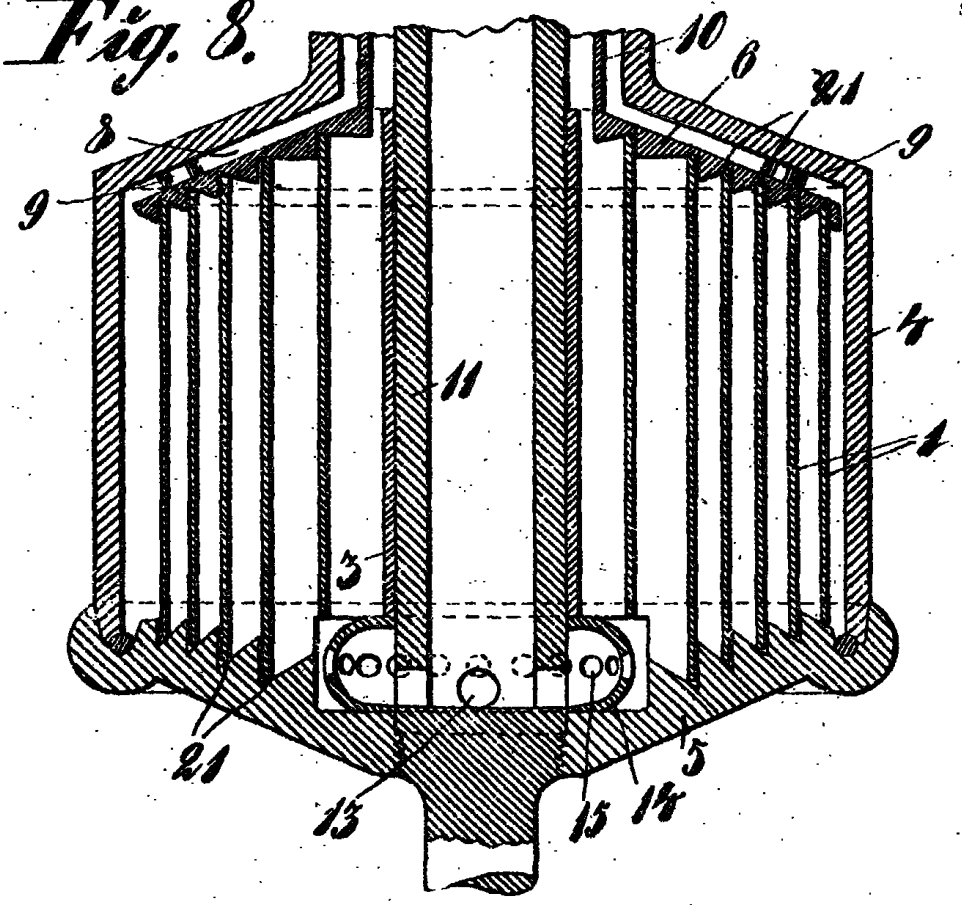


Fig. 9.

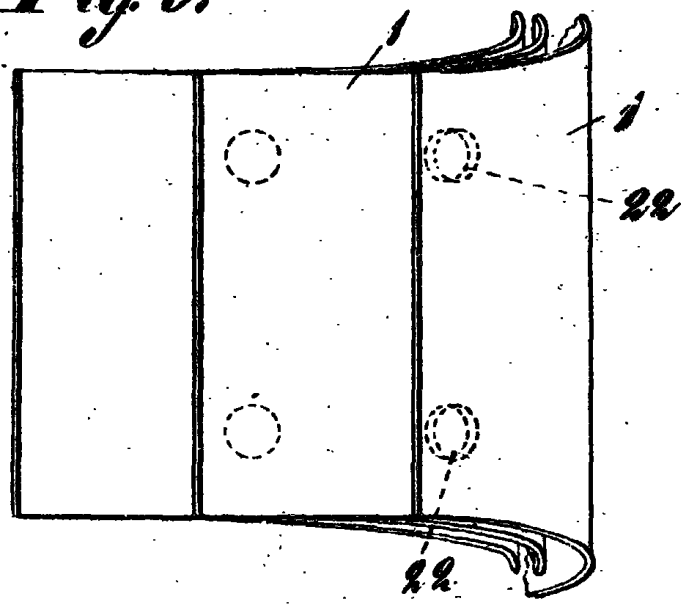
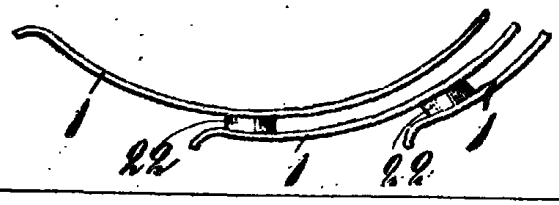


Fig. 10.



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